18. Develop the Butler-Volmer equation in the kinetics of electrode reaction.

19. Describe the importance of Pourbaix and Evans diagrams.

20. (a) Summarize the principle and applications Polarography. (5)

(b) Write notes on Redox flow batteries. (5)

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APRIL/MAY 2025

23PECH14A — ELECTROCHEMISTRY

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. What is Bjerrum model in electrochemistry?

2. State Debye Huckel limiting law.

3. Mention the importance of stern model of electrical double layer.

4. Define electrophoresis.

5. Define net current density.

6. What are Tafel plots?

7. What is meant depolarization?

8. Draw and delineate Evan's diagrams.

9. What are the electrodes associated with an electrochemical cell used in Cyclic Voltammetry?

10. Define high temperature fuel cells.

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) Derive Debye-Huckel limiting law at appreciable concentration of electrolytes.

Or

(b) Deduce Van't Hoff factor and its relation to colligative properties.

12. (a) Derive Lippmann equation.

Or

(b) Write a brief note on zeta potential.

13. (a) Derive Nernst equation and explain the terms involved in it.

Or

(b) Write notes on low and high field approximations.

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14. (a) Obtain a Butler Volmer expression for multi-step reaction.

Or

(b) Deduce the anodic and cathodic orders for the reduction of I_3^- ion.

15. (a) Explicate the working principle of lithium-ion batteries.

Or

(b) How are fuel cells classified? Give an example for each case.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Derive Debye Huckel limiting law equation and explain the qualitative and quantitative verification.

17. How is the structure of an electrical double layer characterized in terms of the three models namely Stern, Helmholtz-Perrin and Guoy-Chapmann?